REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-8 and 10-11 are currently pending, Claims 1, 10, and 11 having been amended, and Claim 9 having been canceled without prejudice or disclaimer. The changes and additions to the claims do not add new matter and are supported by the originally filed specification, for example, on Fig. 12 and page 33, line 13 to page 35, line 24.

In the outstanding Office Action, Claims 1-6 and 10-11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Butter et. al. (U.S. Patent No. 6,549,575 B1, hereafter "Butter") in view of Karczewicz et al. (U.S. Patent No. 6,950,469, hereafter "Karczewicz"); Claims 7 and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Butter in view of Karczewicz and Park et al. (U.S. Patent No. 5,825,930, hereafter "Park"); and Claim 9 was rejected under 35 U.S.C. §103(a) as being unpatentable over Butter in view of Karczewicz and Legall (U.S. Patent No. 5,761,398).

With respect to the rejections of Claim 1 under 35 U.S.C. §102(b), Applicants respectfully submit that the amendment to Claim 1 overcomes this ground of rejection. Amended Claim 1 recites, *inter alia*,

> detecting, at the apparatus, an optimal motion vector while sequentially changing the pixel-based sizes of the plurality of motion compensating blocks, using each of the motion vector search ranges determined in the determining motion vector search ranges, by taking the motion compensating block having the greatest pixel-based size and performing a plurality of separate and independent sequences of incrementally dividing the motion compensating block having the greatest pixel-based size into smaller regions, and applying a size-reduced motion vector search range which is based on the motion vector search ranges to each of the smaller regions, each sequence dividing the motion compensating block having the greatest pixel-based size into different smaller regions than each of

> the other sequences and each of the sequences is performed substantially simultaneously to each other.

Applicants respectfully submit that the applied art fails to disclose or suggest at least these features of amended Claim 1.

Butter is directed towards a method of hierarchically searching a reference picture to find a suitable macroblock for constructing a motion vector between the reference picture and a current picture. Fig. 3 of Butter shows a method of motion estimation, in which neighboring frame is searched to find a macroblock 213 which best matches a macroblock 211 in a current frame (see col. 5, lines 29-34). Such a process will yield motion vectors which translate the position of an image from picture to picture (see col. 5, lines 39-41). In performing the search, Butter describes a hierarchical search unit 201 in Figures 5 and 6 that normally performs a search using down-sampled data (see col. 6, lines 3-5). The search unit 201 stores and fetches luminance search data for both I and P frames (see col. 6, lines 9-11). The luminance search data is equivalent to the inputted current macroblock (CMB) with downsampling applied if selected by the user (see col. 6, lines 13-5).

Butter describes that the search unit 201 performs a typical search using downsampled full pixel values. After the best downsampled match is determined using non-reconstructed current macroblock (CMB) data from past and/or future I and P frames, a refinement search unit 221 performs a non-downsampled full pixel search using reconstructed refinement search data around the offset of the best downsampled match (see col. 6, lines 57-64).

Thus, Butter describes searching a reduced (downsampled) macroblock first, and then refining the search by searching a non-reduced (non-downsampled) macroblock "around the offset" of the best downsampled match.

However, even if Butter describes determining a motion vector search range on the non-reduced macroblock as a result of the above-described process, Butter does not disclose

then taking the non-reduced macroblock (as a motion compensating block having the greatest pixel-based size) and performing a plurality of separate and independent division sequences substantially simultaneously to each other in which the macroblock is incrementally divided into smaller regions, and applying a reduced search range, which is based on the initially determined search range, to each of the smaller regions.

Therefore, Applicants submit that Butter fails to disclose or suggest "detecting, at the apparatus, an optimal motion vector while sequentially changing the pixel-based sizes of the plurality of motion compensating blocks, using each of the motion vector search ranges determined in the determining motion vector search ranges, by taking the motion compensating block having the greatest pixel-based size ***and performing a plurality of separate and independent sequences of incrementally dividing the motion compensating block having the greatest pixel-based size into smaller regions, and applying a size-reduced motion vector search range which is based on the motion vector search ranges to each of the smaller regions, each sequence dividing the motion compensating block having the greatest pixel-based size into different smaller regions than each of the other sequences and each of the sequences is performed substantially simultaneously to each other***," as defined by amended Claim 1.

Applicants note that the Office Action had acknowledged that Butter fails to disclose or suggest "sequentially changing the pixel-based sizes of the motion compensating blocks from a greater pixel-based size to a smaller pixel-based size," as was recited in previous Claim 9 (now canceled)." (See Office Action, at page 10). The Office Action relied on Legall to remedy this deficiency of Butter.

Legall is directed towards a 3-stage hierarchical motion vector determination in which each stage uses a higher resolution macroblock (see col. 10, line 26 to col. 11, line 5). Figure 4B of Legall shows a process where in each stage of the hierarchy, a macroblock is

decimated into macroblocks of smaller sizes (see steps 100 and 106). The decimated macroblocks are used as targets for obtaining a frame based motion vector in each stage of the hierarchy (see col. 10, lines 34-44). In a first stage of the hierarchy, a 16 x 16 macroblock is decimated by a factor of 4 horizontally and a factor of 4 vertically to produce 4 x 4 blocks (see Fig. 4B, step 100 and col. 10, lines 27-31). Based on this decimation process, a frame-based motion vector and a field-based motion vector are retained (see step 104, and col. 10, lines 43-52). Then, in a second stage of the hierarchy, the 16 x 16 macroblock is decimated by a factor of 2 in the horizontal direction and a factor of 2 in the vertical direction to produce 8 x 8 blocks (See step 106). Then the selected frame-based motion vector and field-based motion vector retained from the previous stage are refined (step 108, see col. 10, lines 59-60). Thus, Legall describes two separate stages in a hierarchy in which a macroblock is decimated by a factor of 4 in a first stage, and then by a factor of 2 in a second stage. However, the frame-based motion vector and field-based motion vector are found in the first stage and then refined in the second stage. Therefore, these stages are not independent of each other and are not performed substantially simultaneously to each other.

Therefore, Applicants submit that Legall does not show "detecting, at the apparatus, an optimal motion vector while sequentially changing the pixel-based sizes of the plurality of motion compensating blocks, using each of the motion vector search ranges determined in the determining motion vector search ranges, by taking the motion compensating block having the greatest pixel-based size and ***performing a plurality of separate and independent sequences of incrementally dividing the motion compensating block having the greatest pixel-based size into smaller regions, and applying a size-reduced motion vector search range which is based on the motion vector search ranges to each of the smaller regions, each sequence dividing the motion compensating block having the greatest pixel-based size***

into different smaller regions than each of the other sequences and each of the sequences is performed substantially simultaneously to each other," as defined by amended Claim 1.

Therefore, Applicants submit that Legall fails to remedy all of the deficiencies of Butter and Karczewicz with regard to amended Claim 1.

Park has been considered but fails to remedy the deficiencies of Butter, Karczewicz, and Legall with regard to amended Claim 1. Therefore, Applicants respectfully submit that amended Claim 1 (and all associated dependent claims) patentably distinguishes over Butter, Karczewicz, Park, and Legall, either alone or in proper combination.

Amended independent Claims 10 and 11 recite features similar to those of amended Claim 1 discussed above. Therefore, Applicants respectfully submit that amended Claims 10 and 11 (and all associated dependent claims) patentably distinguish over Butter, Karczewicz, Park, and Legall, either alone or in proper combination.

Consequently, in light of the above discussion and in view of the present amendment, the outstanding grounds for rejection are believed to have been overcome. The present application is believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

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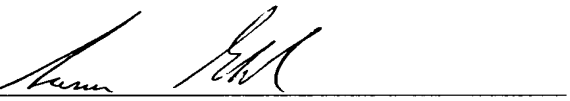

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